Concept for True Hypersonic Guided Missiles Boosted by EM Railgun Instead of ICBM-Style Rocket Boosters; Reduced Cost and Increased Stealthiness of Launch Process

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Introduction

When we hear stories about hypersonic missiles, we rarely hear mentioned the extraordinary cost, the high visibility of the launches themselves or of the inherent inefficiency of utilizing essentially what is an ICBM to deliver a single conventional warhead.

The U.S. not only scrapped its hypersonic vehicle program a number of years ago, but it scrapped its railgun program as well. These two technologies, when used appropriately, can work hand-in-glove to help us to create a practical hypersonic version of the Tomahawk.

Abstract

The Chinese development of an ICBM-launched hypersonic missile was inspired by the idea that the U.S. had the ability to shoot down missiles in their terminal phase of flight, which is only partially true. Although the capability certainly exists to shoot down incoming missiles in any phase of flight, the common availability of decoy re-entry vehicles makes it impractical to attempt terminal phase shoot-down. The cost of launching an ICBM to deliver a single conventional warhead makes a hypersonic capability along these lines impractical and truly a symbolic achievement more than anything else.

It is true, however, that sub-sonic cruise missiles are vulnerable to shoot-down by CIWSs and that a missile capable of hypersonic flight without the need to bring its own fuel along would be a significant achievement. Nearly infinite range coupled with the ability to sustain velocities above Mach 5 would make such a system truly revolutionary.

Rather than boosting such a vehicle with an ICBM, I propose the use of an electromagnetic rail gun to boost a guided vehicle equipped with shielding capable of protecting the guidance components. Exiting the rail gun at speeds of over Mach 2.5, the missile would have sufficient velocity to achieve the steps necessary for self-sustaining propulsion in our atmosphere that, fortunately for us, contains large quantities of a highly combustible material called water vapor.

With sufficient electrical energy, a process of rapid hydrolysis can separate hydrogen ions from the water vapor in the atmosphere. To achieve this, the hypersonic missile must have two distinct air intakes. The first air intake would direct air over a specialized medium designed to maximize the generation of static electricity from friction with the air. At 1800 MPH, the power generated would be sufficient to liberate substantial quantities of

hydrogen from water. At the speeds involved, however, there would not be time enough for hydrogen bubbles to gently rise to the surface of a solution in support of a more typical hydrolysis process similar to that with which we are familiar.

The second air intake would lead to a condenser which would take advantage of the extreme velocity of the vehicle to separate water vapor from the air. The water would be highly compressed, pushing water molecules into close proximity with one another to the maximum extent possible. At the point of greatest compression, accumulated static electricity generated by friction with air in the above generating chamber is discharged in a pulsed fashion, maximizing the efficiency of the hydrogen separation.

This arc would take the form of an intense guillotine of electrical current running from top to bottom that separates hydrogen from water without combusting that hydrogen, something made possible by the narrow focus and brief bursts. The condensed water then goes through a phase of decompression. The water vapor being decompressed passes by the walls of the combustion chamber which have a series of small "hot plates," heated by electricity generated by a combination of piezo-electric fibers that generate electricity in response to the pressure of wind blowing against them as well as thermo-electric power generated by the plate to which the fibers in that chamber attach. The best reason for using a combination of both piezo-fibers and thermo-plates is that in the moments after firing the missile, the fibers/plates would not have had a chance to heat up and the only power would be coming from the piezoelectrically-driven part of that mechanism. The thermo-electric component of the mechanism serves a double-function both as an additional source of power and to aid in preventing overheating of the piezo-fibers. In fact, it may be inevitable that the piezo-fiber component will partially degrade at high temperatures but that its remnants will protrude enough to create the friction needed to continue to power the missile thermo-electrically. This missile cannot incorporate capacitors or batteries of any kind in light of the mechanism that would be used to launch it.

The dynamics of small quantities of H-O molecules detonating in a vapor are quite different than those of detonations of small pockets of H-O immersed in water. Hydrogen, it is worth noting, actually heats up when it is decompressed, unlike most gasses. Nonetheless, to generate the heat required to ignite the water vapor/H-O mixture, the hot plates are a necessity. Even if only 10% of the vapor consists of separated water, it would be enough to chain react and propel the missile.

Once ignition is achieved, the speed of the missile increases, further improving the efficiency of the propulsive process. The primary limited to speed and range in this design would be the durability of the electrical generating chamber under high-heat conditions.

The question then becomes one of what sort of mechanism is best-suited to convert wind into electrical energy. The most efficient method would be not a turbine (they tend to fail under these conditions) but rather a series of metallic piezo-electric flexion fibers very similiar to the ones I described in my publication of April 3rd of this year wherein I discussed an alternative to

turbines for the conversion of energy in flowing fluids like wind and water into electricity.

These sorts of materials can generate electricity in response to torsion or flexion, necessitating in this case only that the fibers be strong enough to stand up to wind speeds of around 3500 MPH and intense heat. A natural turbulation would persist within the mechanism provided that the metallic fibers are arrayed in an alternating pattern similar to pegs on a Plinko board. Any energy not converted into electricity through flexion could be converted thermo-electrically. This is the science that makes possible the art of moving the heat-energy associated with the friction of hypersonic flight and shifting it from the skin of the missile as much as possible toward the electrolysis and combustion chambers. Provided that this energetic transport can be accomplished, any missile that can be given an initial boost to the needed speed (and shielded from the EM associated with that boost) could easily propel itself almost indefinitely and would be capable of striking any point on Earth.

The unreliability of turbines under high-heat conditions was the ultimate cause for the scrapping of initiatives such as Project Pluto that sought to harness miniaturized nuclear reactors to power cruise missiles with infinite range. A more recent Russian initiative to build a similar missile resulted in the death of dozens of Russians by radiation poisoning and the scrapping of that particular program. Clearly, using nuclear power generation to drive individual missiles is not a viable solution, nor is the use of turbines in high-heat environments.

Conclusion

I submit that my basic design for a next-generation hypersonic missile would constitute the first "true" hypersonic missile as we understand it and certainly the first practical and cost-effective design. By employing the latest discoveries in materials science, we can make hypersonic, self-fueling missiles a practical reality.